Combolook
Color HD S2/T2/C
User Manual

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Thank You for purchasing the Emitor International AB Combolook Color HD S2/T2/C instrument.

This manual covers the operation and maintenance of the Emitor International AB Combolook Color HD S2/T2/C instrument used for satellite dish alignment, TV and CATV alignment and signal analysis.

All information in this publication is based on the latest product information available at the time of printing.

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This manual should be considered a permanent part of the instrument and should remain with it if the instrument is resold.

If a problem should arise, or if you have any questions about the instrument, consult an authorized Emitor International AB dealer.

Notice

Operating the Combolook Color S2/T2/C instrument requires special skills. Please read this User Manual thoroughly before operating the instrument.

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Overview

The Emitor Combolook Color HD S2/T2/C is a Swedish designed Satellite (DVB-S/S2)- and Terrestrial (DVB-T/T2)- instrument and spectrum analyzer. The unit is designed for the exact alignment and adjustment of satellite dishes and terrestrial antennas.

This instrument is intended to be used by the professionals when accurate and precise information is needed. With ease of operation through powerful processor technology, basic operation is achieved with only a few controls. The functions are easy to access and only take minutes to learn. Many functions can be controlled by the enclosed Remote control.

A 5 inch 16:9 color TFT-LCD display is provided which shows MPEG2 “Free to air” satellite- , terrestial- and Cable- TV channels transmitted in DVB-S, DVB-T or DVB-C. It also displays the frequency spectrum and digital information regarding the signal.

Menus and help displays are shown on the LCD screen (64x128) beside the monitor and a keypad is used for the function selection. The knob is used for frequency and other operations. A remote control is provided which allows most of the keypad commands to be used to control the instrument.

The mode of operation is selected at power on, and to conserve battery life only the necessary functions are enabled. Switching modes can be done at power on or by menu selection.

Satellite-TV (DVB-S/S2) Instrument Mode

The Spectrum shown enables the measurement of the satellite spectrum in resolution steps of 1 MHz to 10 MHz making it easy for the skilled installer to know what satellite he is receiving and make more detailed measurements. The Spectrum function spans the frequency band 920-2150 MHz and can be expanded from 4 MHz down to 1 MHz steps. Automatic frequency conversion to the user defined LNB type is shown on screen so no calculations are needed to determine the Satellite frequency. Cross polarization at a frequency can be easily checked with the cross polarization function. The instrument has high resolution for accuracy. It presents measured data ±2 dB (at 20o C).

Frequency tuning is done with the main knob in frequency steps between 4 MHz and 1 MHz depending on the span of the spectrum. When the spectrum is displayed, Automatic Spectrum Identification is provided by accessing the NIT information by hunting for a DVB-S signal from one of the transponders.

Digital-TV pictures (DVB-S Free to Air) can be displayed with sound.

DVB-S/S2 MPEG2 and MPEG4 digital signals can be tuned in and locked.
The Digital Mode shows extended information of Modulation, SIG, SNR, BER, MER, and a constellation diagram. The Satellite Name and position are shown using the Network Information Table in the MPEG transport stream. Channel detail (or Service Information) can also be displayed for a transponder if needed.

The user memory positions can save spectrum displays, analog channels, digital channels and Saved spectrum positions can be mixed simultaneously with an actual reading for easy comparison and control of signal-levels. Measurements on group of channels can be made with up to 10 frequencies simultaneously with automatic polarization and band selection.

For Universal LNBs, the polarisation V/H is switchable by 13/18V and Lo/Hi band with 22 kHz-tone.
The instrument features circuitry protection to prevent short circuits during connection of the LNB.

The DiSEqC function controls all DiSEqC accessories such as switches and positioners.

Digital-TV (DVB-T/T2/C) Instrument mode

The Spectrum is shown from 2MHz to 900MHz and can be zoomed to smaller segments (minimum 13MHz span) for closer inspection. In TV mode, it presents measured data in dB with high accuracy ±1 dB (at 20o C). The Combolook Color HD is capable of working with the return-path signals in Cable-TV networks (5-65 MHz) according to the EN50083 standard. Signal to Noise measurements and Digital Channel power measurements can be made using Reference markers on the spectrum.

Digital-TV pictures (DVB-T and DVB-C Free to Air) can be displayed with sound.

DVB-T MPEG2 and MPEG4 digital signals can be tuned in and locked.
The instrument can measure C/N, BER and MER.

Attenuation can be inserted from 0-45dB to determine picture quality with increased attenuation. TV Channels can be saved as favorites for easy tuning.

The user memory positions can save spectrum displays, analog channels, digital channels and Saved spectrum positions can be mixed simultaneously with an actual reading for easy comparison and control of signal-levels.

The Combolook Color HD S2/T2/C is powered by a built- in, rechargeable Li-Ion battery. The battery can be recharged using either the included external battery charger or the car-adaptor.

The Combolook Color HD S2/T2/C weighs less than 4kg including the battery and the carrying case.

Unpacking

Unpack the instrument and check that the following items are included:
1. Combolook Color HD S2/T2/C instrument.
2. Nylon carrying case with shoulder strap.
3. Power supply and charger 110-230VAC /14 VDC, center pin positive
4. Auto Adapter cord (Car charger) 12V.

Operating Controls

The side view of the Combolook Color HD S2/T2/C is shown below with the operating controls indicated.

Power Switch) On battery power, this turns the instrument on and off. When the charger is connected, the instrument will charge with the switch off, and operate when on. The instrument will not charge when operating.

Charger Power Input) The instrument can be charged or operated using either the supplied 14V power supply or from a 12V car cigarette lighter plug using the supplied connector.

Keypad) This is used to select most of the functions from the menu.

RF Input from LNB) This is the LNB input. It supplies 13V/18V and the 22kHz signal when required.

Audio Volume) The audio volume can be adjusted for either the Digital reception.

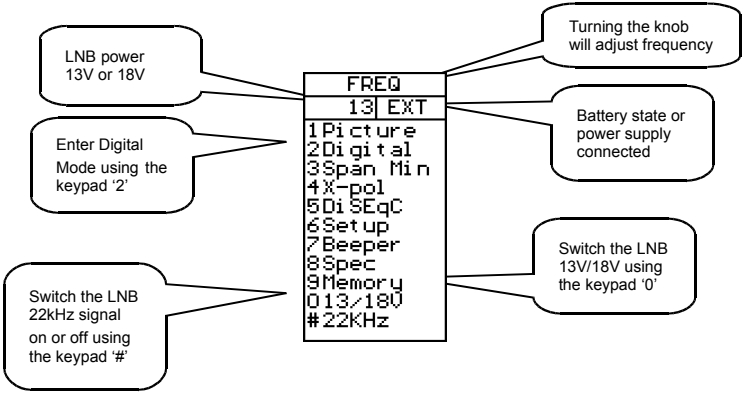
Tuning Knob) This knob is used for frequency selection and other functions. The knob includes a push button that is used for selection. In the Spectrum mode, the tuning knob is used for frequency adjustments, bandwidth (span) adjustments and signal Offset level. The knob button is used to change the mode. In the Digital Picture mode, the knob is used to select the next picture, and for memory selections. In the Digital mode, the knob is used for frequency selection and memory selection.

RS232) This port is used for firmware updates and updates of channel information.

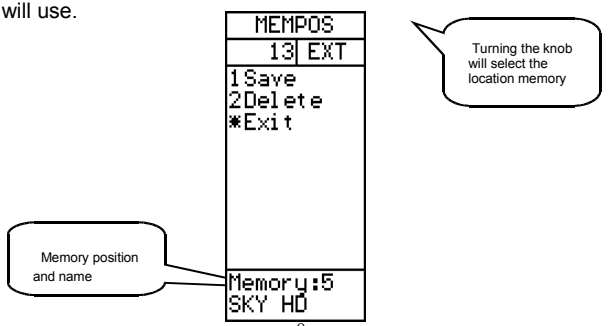
Video and Audio Output) The video and audio signal can be output to another device for viewing.

LCD

The LCD window shows the current functions available using the kedjad or remote. For each function, the keypad number is shown to the left. Also shown is the current status of the LNB, the knob operation mode, and the battery/external power. Shown below is the LCD display in the Spectrum mode.



When the operation can use a memory location, the lower portion of the LCD shows the current memory selection. For this case, the knob is used to change the memory position number that the 'Save' will use.



Remote Control

Power
Not used

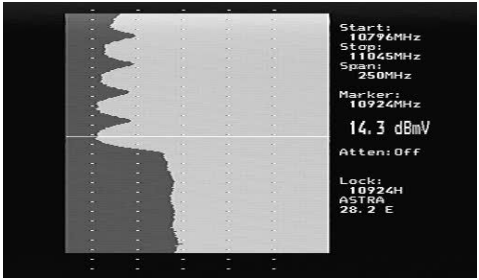
Exit
(keypad *)

Used for keypad '#' which is 22kHz control to select band

Previous channel

Next channel

Satellite Instrument Mode
-Spectrum Operation (Sat)



The Spectrum Mode is displayed when the instrument is turned on in Satellite mode. With a dish and LNB connected, it will show a display similar to that above. The spectrum is displayed with the Start frequency at the top of the screen and the Stop frequency at the bottom. The Span is the total frequency coverage or the difference between Stop frequency and Start frequency. The current signal level (14.3 dBmV in this example) is displayed for the frequency at the Marker. The knob is used to change this to the frequency of interest.

When Spectrum Mode is entered, the peaks are checked to see if the demodulator can lock. If a lock occurs, the NIT data for the transponder is displayed for automatic satellite identification. NIT data on a transponder is repeated at least every 10 seconds and on most satellite more often than this.

The span of the Spectrum can be changed in two ways. Pressing the keypad '3 Span' will change the spectrum to the minimum span of 250MHz. For this span, each division is 1MHz. An alternate method is to use the adjustable span. Pressing the knob allows the span to be adjusted from a minimum of 250MHz to the maximum of 1231MHz. At this maximum span, the entire IF band from 920MHz to 2150MHz is displayed.

When span is adjusted by pressing the knob, a second press of the knob allows the "DC Offset" of the spectrum to be adjusted for best display. A further press of the knob restores the operation to frequency adjustment. The span setting from the knob remains as the current setting. The "DC Offset" is restored to 0.

The current band being displayed can be changed with the 22kHz signal using the keypad '# 22kHz'. For Universal LNBs, when the 22kHz is off, the band is Lo Band (920MHz to 11900MHz) and when the 22kHz is on, the band is Hi band (11520MHz to 2150MHz)

There is a small overlap from 11520MHz to 11900MHz, so a Universal LNB can tune this range with 22kHz either on or off.

.
Picture) Allows the display of Analog or Digital channels. (see Analog Picture Mode page 16 or Digital Picture Mode page 14)

Digital) Changes to Digital mode at frequency of marker.

Span Min/Max) Changes the spectrum bandwidth fro 250MHz to 1231MHz.

X-Pol) Performs a cross polarisation check at the marker (or nearest peak) and displays the result at the lower right of the TFT.

DiSEqC) See DiSEqC on page 18.

Setup) See Setup on page 19.

Beeper) The Beeper function is enabled or disabled and can be used to provide an audio signal of the signal level at the marker position.

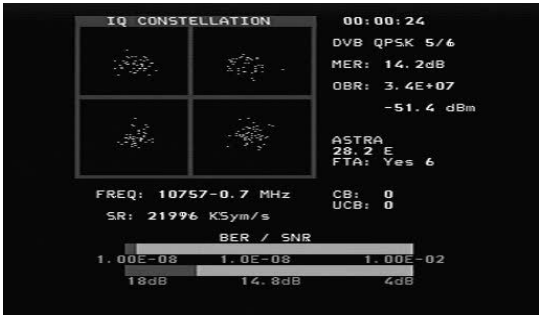
Spec) See the Special Spectrum functions on page 21.

Memory) This allows saving or mixing the Spectrum with saved spectrum pictures. See the Special Spectrum Mix on page 21.

13/18V) Switches the LNB voltage between 13V and 18V.

22kHz) Switches the LNB 22kHz signal which switches between Lo band and Hi band for Universal LNBs.

Digital Mode (Satellite)

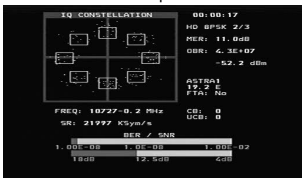


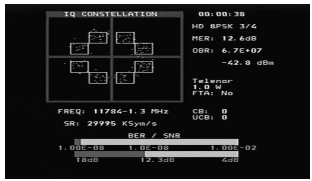
This shows a typical constellation from a DVB-S QPSK signal. The frequency and offset are shown below the constellation diagram and the measured symbol rate is shown below the frequency. The two thermometer bars show the BER and SNR of the signal. The SNR thermometer increases from right to left and the BER thermometer gets smaller from right to left, so that the best signal is shown by a longer white bar.

The lock time is shown at the top right and below this, the signal modulation and FEC. The MER (Modulation Error Ratio) and the Output Bit Rate for the total transport stream is also shown.

The signal level at the tuned frequency is shown below the Output Bit Rate. When the NIT information is available, the NIT name and NIT Orbital Position appear. Reading the SDT data from the transponder shows the number of “Free to Air” channels. A running count of the CB (Corrected Bit) and UCB (Uncorrected Block) errors is shown as long as the signal is locked.

For DVB-S2, the BER count is not available and the BER shown is an estimate formed from the Total Block Count, Correctable Block Count and Bad Block Count. It is recommended to use MER for DVB-S2 optimization. When the modulation is DVB-S2 8PSK, the constellation is shown with target boxes overlayed. They may appear in two orientations as shown below. The target boxes will move to the ideal positions for the 8PSK Constellation presentation.





Digital Mode Functions (Satellite)

Search +/-) A signal search can be initiated by using the keypad '1 Search +' to search with increasing frequency or '2 Search –' with decreasing frequency. The search mode moves to the next peak in the spectrum and attempts a lock for DVB-S QPSK, DVB-S2 QPSK and DVB-S2 8PSK signals. The symbol rate is determined automatically. Because the time to lock for low symbol rate signals increases the lower the symbol rate, symbol rate signals below about 16000 will not lock during a search.

Memory) Frequencies are stored in the Digital memory. (See Memory page 13)

Channels) When a signal is locked, the Digital services from the SDT Service Information will be displayed on the TFT screen.

DiSEqC) DiSEqC commands can be initiated. (See DiSEqC page 18)

Beeper) Enables or disables the Beeper at the frequency.

13/18V) Switches the LNB voltage between 13V and 18V.

22kHz) Switches the LNB 22kHz signal which switches between Lo band and Hi band for Universal LNBs.

Exit) Returns to the Spectrum display.

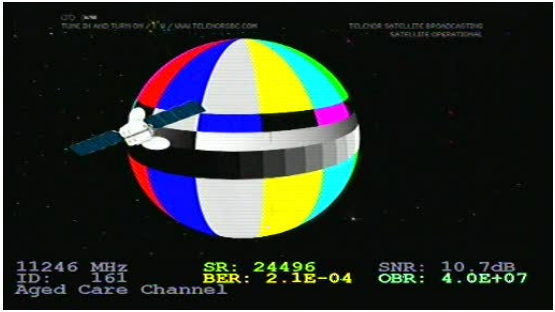
Digital Picture Mode (Satellite)

From the Digital display, when the input frequency is locked and the modulation type displayed, the SDT data can be examined using the Channels function with keypad '4 Channels'. This shows a list of the services on the transponder. Encrypted channels are shown in RED and cannot be selected. The current selected channel is shown in WHITE. FTA channels are shown in GREEN and radio channels are shown in YELLOW.

When there are FTA channels available, the current selected channel can be opened by keypad '3'.

Using the keypad '3 Open' shows the selected picture or if a radio channel plays the audio.

Display which is available using the keypad ‘4 SNR Info’ function or the keypad ‘5 Pic Info’ functions.



Memory Functions (Satellite)

There are four different user memory types in the Combolook Color HD S2/T2/C instrument. They are divided according to the type of data storage required. Each memory area is chosen automatically depending on the type of data.

Spectrum Memory: There are 100 memory positions reserved for User data of the spectrum waveforms. This data can be loaded and viewed or mixed with the current signal for comparison.

Analog memory: There are 100 memory positions reserved for User data of Analog frequencies. Each position stores the Name, frequency, 13/18V, and 22kHz state.

Digital Memory: There are 100 memory positions reserved for User data of Digital frequencies. Each position stores the Name, frequency, 13/18V, and 22kHz state.

Digital Channel Memory: There are 100 memory positions reserved for User data of Digital Channels. Each position stores the Name, Service ID, frequency, 13/18V, and 22kHz.

Text Editor (Satellite)

All the User memory areas use the Text Editor for saving the name for the memory position. With the Digital Channel memory, the current channel name is entered from the SDT data and usually this name is correct and all that is required is to save the name. With the other memory positions, a name requires manual entry. Use the knob to select the characters from the list and the knob select button to enter the character. Characters can be deleted by using the keypad '1 Delete' and the current position can be changed by the keypad '2 Left' or '3 Right'. The keypad '* Save' completes the entry and saves the name to the memory position.

DiSEqC Functions (Satellite)

The Combolook Color HD S2/T2/C instrument supports all usual DiSEqC commands for the DiSEqC specifications 1.0, 1.1 and also supports the Goto X function for easy positioner movement. The DiSEqC commands can be accessed from several menus for convenience.

From the Spectrum Mode: keypad '5 DiSEqC'
From the Digital Mode: keypad '5 DiSEqC'
From the Multichannel Mode: keypad ' 8 Spec', keypad '5 MultiCH', keypad '5 DiSEqC'

In the DiSEqC menu, the DiSEqC commands LNB1, LNB2, LNB3, LNB4 as well as Tone Burst A and Tone Burst B can be sent.

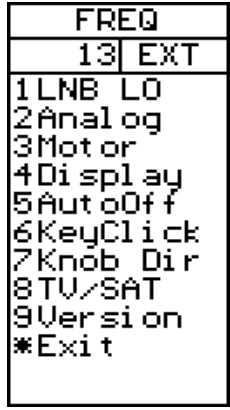
For Switches, the SWx command allows the switch commands SW1 up to SW16 to be sent.

The Motor command allows the operation of positioners. Go East and Go West move the positioner as long as the key is pressed. Calibrate moves the positioner to the home position, usually due south. Limits allow "soft" limits to be set or cleared for the positioner. Position allows the setting a movement to defined positions, The Go East command and Go West command are used to move the positioner to an optimum position, and then that position is saved from 1 to 31. (Goto position 0 commands the positioner to its home position.)

The Goto X (also called USALS) command removes the necessity to find positions manually. To use the Goto X function, the instrument latitude and longitude must be known. Once these are set, they are stored in permanent memory and so will not be lost on power down. Once the latitude and longitude are correct, the positioner can be commanded to move directly to a satellite orbital position.

Setup (Satellite)

The Setup menu contains the functions which are used infrequently.



LNBLO) The LNB type can be selected in this menu. The LNB local oscillator down converts the satellite frequency (10670MHz to 12750MHz) to the intermediate frequency (920MHz to 2150MHz). If conversion is desired, the IF setting is used.

Analog) The default for the Analog Picture inversion be set here. Normal is used by Ku Band and Invert used for C Band.

Motor) The positioner type can be set here. The most common positioner type is DiSEqC (Dis 1.2) the other types supported are Satsel and Satscan.

Display) The display units for signal level can be to dBuV, dBm, or dBmV.
The LCD contrast can be adjusted and the LCD backlight enabled or disabled. The Spectrum Graticule can be turned on for dB guidelines.

AutoOff) AutoOff can be set to turn the unit off automatically after a number of minutes if no knob of key actions occur. AutoOff does not operate when on external power.

KeyClick) The beep for a keypress can be enabled or disabled.

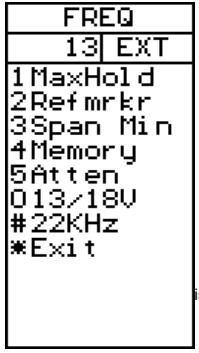
Knob Dir) The direction of movement for the knob can be changed for frequency adjustments and for other functions such as selecting the displayed picture. The default is clockwise rotation of the knob is increasing frequency and moves the onscreen selection down.

TV/SAT) The instrument mode when turned on can be selected to start either in TV mode or Satellite mode. A third option is available which will ask the user on startup to select the mode. If no selection is made within 20 seconds, the instrument will turn off.

Version) The version menu displays serial number, levels of the firmware and related information.

Special Functions (Satellite)

MaxHold) This sets the measurement of signal level to hold and display the maximum received values. Once enabled, the measurements will remain in MaxHold until expressly disabled.

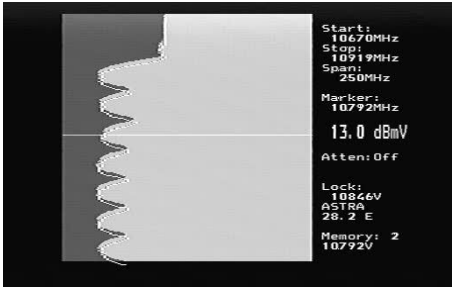


Refmrkr) The Reference marker allows a second marker to be placed on the spectrum display. Adjust the marker to the required second location and set the reference marker. Now when the marker is moved to another location on the spectrum display, the difference in dB level and the frequency difference are displayed.

Span Min/Max) The span can be changed when on this menu for convenience. It is the same as the span setting on the Spectrum menu.

Memory) Samples of spectrum data can be saved in memory and then either displayed or mixed with the current spectrum. When the mix function is chosen, the current spectrum is adjusted to the same span and starting frequency, and then the spectrum from memory overlayed as a line image so that you can compare the current signal with a saved spectrum.

The spectrum memory is selected using the knob and the memory position is displayed on the TFT. Spectrum memory can be loaded for examination as well as mixed.



Atten) The 15dB attenuator can be inserted or disabled from this menu.

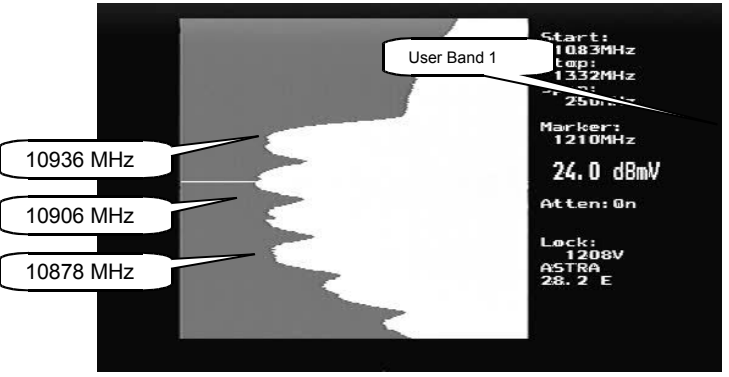
13/18V) The 13V/18V LNB voltage can be changed at this menu for convenience.

22kHz) The 22kHz LNB signal can be changed at this menu for convenience.

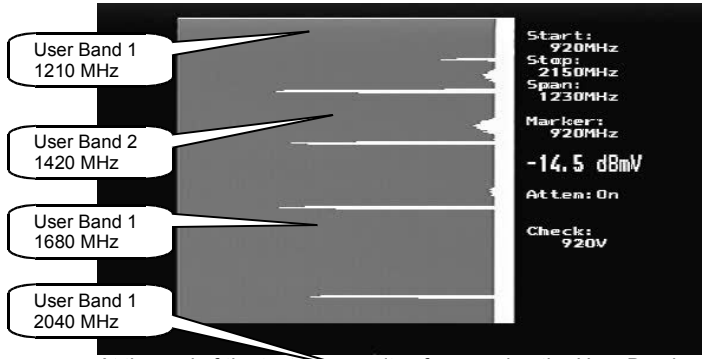
SatCR (UniCable) LNB Functions (Satellite)

When a SatCR LNB is first connected, there will be no signal. This is because in the Spectrum mode, no UniCable commands are issued. Command the SatCR LNB by switching to the Digital mode and back to the Spectrum mode and it will show a spectrum. (Turning on and off the LNB 13/18 or the LNB 22kHz will also command a UniCable frequency.) The span of the spectrum can be set to either 250MHz or 1231MHz (the maximum or minimum) by pressing the keypad 'Span'. The Marker frequency shows the IF frequency of the User Band. The translated SatCR signal will be at the chosen User Band and about 100MHz wide. For the UniCable LNB, the LNB 13V/18V and the LNB 22kHz signal represent the Polarisation and the Band and are not sent to the SatCR LNB. In the Digital mode, the frequency shown is the SatCR commanded frequency.

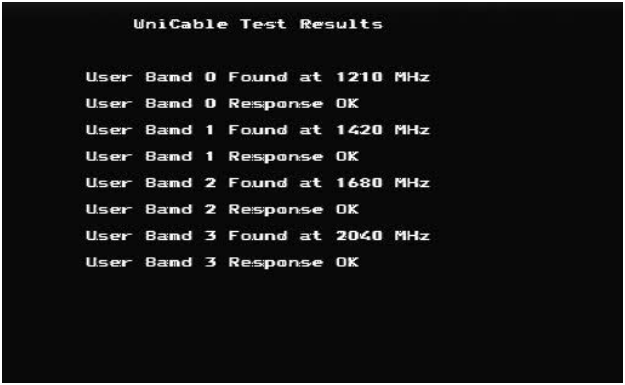
Remember that the displayed SatCR band is reflected in frequency about the User Band frequency as shown in the example below. For more details see Appendix D.



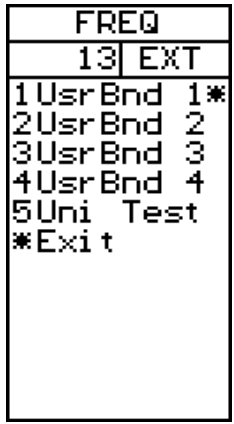
The SatCR test (Spec -> UniCable -> Uni Test) allows full testing of a SatCR LNB. This test takes about 20 seconds to check each User Band. During the test, the four User Bands are identified and any offset found is used for further SatCR tuning.



At the end of the test, the results of measuring the User Bands are presented.


UniCable Test Results
User Bamd 0 Found at 1210 MHz
User Bamd 0 Response OK
User Bamd 1 Found at 1420 MHz
User Bamd 1 Response OK
User Bamd 2 Found at 1680 MHz
User Bamd 2 Response OK
User Bamd 3 Found at 2040 MHz
User Bamd 3 Response OK

The User Band is set to 1 by default, but for more detailed testing it can be set to any of the four bands, for Example: Spec -> UniCable -> UsrBand 4. Now User Band 4 will be used for any further UniCable Tuning.



Digital TV (DVB-T/T2C) Operation

The instrument will start in Spectrum-mode when TV-mode is selected in start-up and a similar picture like the one below will be displayed.

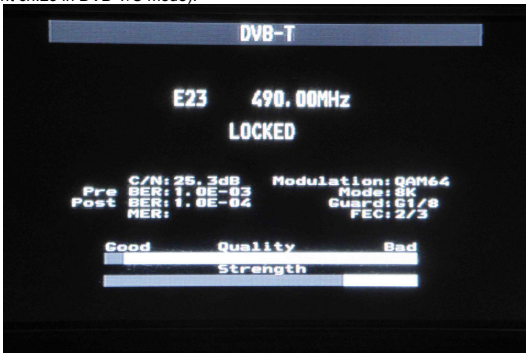
The instrument shows the selected channel of the last entry (in this ex. Channel E25).

Easiest way to install a DVB-T terrestial antenna/measure on a DVB-C channel:
- Start with selecting a channel from the transmitter Your looking for (in this ex. there is a transmitter on channel 23). Simply tune in by using the knob in this mode.

- Remember that some antennas (like many indoor-antennas) needs to be power-supplied. See below: Setup/P-insert, how to do this.

- Press button nr 8 to turn the **Beeper** on/off.
In this mode the meter will measure RF-strength from the transmitter which is presented with higher/lower pitchtones from the loadspeaker. Higher the tone the better the signal. The channel kan be changed by turning the knob in this mode.
The beeper function is also very handy when it´s difficult to align an antenna and trying to watch the display of the meter at the same time.

When the antenna is aligned with Max RF-signal enter the Digital-TV (DVB-T/T2/C) part by selecting #1 in the menu (DVB-T/C) and then DVB-T or DVB-C.
The instrument will present the DVB-T/C channel closest to the frequency which the cursor is pointing at in spectrum (for ex. If the cursor is pointing at 490 Mhz then the meter will present ch.23 in DVB-T/C mode).



For DVB-T, fine tune the antenna in order to get the best (highest) Digital readout.
- Always finetune the antenna in Digital-mode. RF-readout is for finding the transmitter only. Highest Digital-readout is always to be prefered compared with the RF-readout.

The information above tells that the meter has locked on a DVB-T/T2/C (or unlocked) signal and tells about the following DVB-T/T2 quality-parameters of the signal:
BER (Bit Error Rate) The value should be as low as possible.
- Pre BER is before correction by the demodulator and
- Post BER is after correction. Pay more attention to the Pre-value.
C/N (Carrier/Noice) The value should be as high as possible.
MER: (Modulation Error ratio) The value should be as high as possible.

The two thermometer bars show the BER and C/N of the signal. The C/N thermometer increases from right to left and the BER thermometer gets smaller from right to left, so that the best signal is shown by a longer white bar.

The display also shows:
- Modulation: QPSK, QAM16 or QAM64
- FEC: 1/2, 2/3, 3/4, 5/6, 7/8.
- Guard: 1/32, 1/16, 1/8, 1/4.
- Mode: 2K, 8K.
* UCB, Un Corrected Blocks. The value should be as low as possible.

In DVB-C mode the meter will show:
C/N (Carrier/Noice) This value should be as high as possible.
- Pre BER is before correction by the demodulator and
- RS error: Reed-Solomon bad blocks (like the UCB: Un Corrected Blocks) should be as low as possible (should be zero).

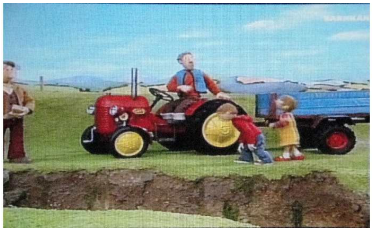
The two thermometer bars shows the quality of the signal (BER and C/N). The scales increases from right to left and the best signals are shown by a longer white bars.

The display also shows:
- Modulation: Different QAM´s between QAM16 to QAM256.
- Symbolrate (approx).

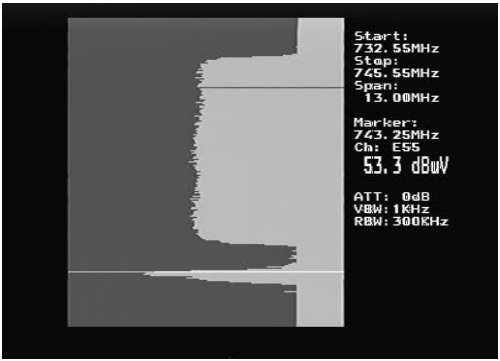
Channels will display the existing TV-channels at a certain transmitter (in this example ch 23).

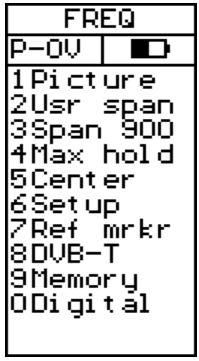
The green colored channels are FTA (Free to air) and can be viewed upon.
The red colored channels are not accessible (coded or other services).

Chose to look at a channel by pressing the “open” button (#3).
- #2 will step to the next (green) channel in the list.
- #3 will step to the previous (green channel in the list.



Spectrum Operation (TV)





When the Combolook Color S2/T2 is first turned on in TV mode, the spectrum is displayed. Upon connection of an aerial or CATV source, it will show a display similar to that above. This portion of a spectrum shows a digital TV signal and an analog TV signal at the marker frequency. The spectrum is displayed with the Start frequency at the top of the screen and the Stop frequency at the bottom. The Span is the total frequency coverage or the difference between Stop frequency and Start frequency. The current signal level (53.3

dBuV in this example) is displayed for the frequency at the Marker. The knob is used to change this to the frequency of interest.

The span of the Spectrum can be changed in two ways. Pressing the keypad '3Span' will toggle the spectrum to the minimum span of 13MHz and the maximum span of 900MHz. For this minimum span, each division is 50 kHz. An alternate method is to use the adjustable span. Pressing the knob allows the span to be adjusted from a minimum of 13Mhz to the maximum of 900MHz. At the maximum span, the entire IF band from 2MHz to900MHz is displayed.

When span is adjusted by pressing the knob, a second press of the knob allows the knob to control the insertion of attenuation from 0dB to 45dB as indicated on the display. "DC Offset" of the spectrum to be adjusted for best display. A further press of the knob restores the operation to frequency adjustment. The span setting from the knob remains as the current setting. The "DC Offset" is restored to 0.

The current video bandwidth (VBW) and Resolution Bandwidth (RBW) are shown. These can automatically or manually set in the Setup Menu.

Main Menu (TV)

In the LCD display, the **knob** function (FREQ, SPAN, ATTEN) is shown and also shown is the status of the Power Inserter to use with amplified antennas (push the knob to change mode).

- Tune the Frequency up/down when FREQ is displayed in the LCD.
- Increase/decrease the span of the spectrum when SPAN is displayed in the LCD.
- Insert attenuation 0dB to 45dB in the signal path. The knob controls the attenuation inserted and the value inserted is reported at the bottom of the LCD display. Pressing "Auto Att" restores automatic control of the attenuator and the value chosen is shown on the LCD display.

1. **DVB-T**) Starts the DVB-T module. See Digital Picture (TV) operation on page 28.

2. **Usr Span**) Sets the spectrum display to a user defined portion of the spectrum. The User span is set up using the Memory Function (TV) described on page 27 .

3. **Span 13** (or Span 900) This toggles the spectrum span to 13MHz (or 900MHz) and centers the spectrum on the marker position.

4. **Max Hold**) Holds the highest signal levels recorded until cancelled. Max hold is useful for monitoring a certain frequency-range for changes. You may see how/if temporary signals/disturbances can affect a network's quality.

5. **Center**) Places the marker frequency at the center of the spectrum using the current span setting.

6. **Setup**) See the Setup (TV) on page 30.

7. **Ref Mrkr**) Sets a reference marker so that differential readings can be made. See Signal-to-Noise Ratio Measurements on page 31.

8. **Beeper**) The Beeper function is enabled or disabled and can be used to provide an audio signal of the signal level at the marker position. It measure at a single carrier (Channel) which is tuned in by using the knob.

9. **Memory**) Save or recall setting from TV memory. See Memory Operation (TV) on page 27.

0. **Digital**) Digital dB or Channel Power Measurement. See page 36.

Memory Operation (TV)

Memory storage exists in several different forms in the TV Mode for the Combolook. The memory can be used to save and retrieve Spectrum samples, User Span settings, and TV Picture tuning favourite settings. The memory positions for Spectrum, User Span, and Picture memory are in different areas.

From the Spectrum display:
Memory -> Spectrum -> Save) This saves the current displayed spectrum for later review and processing. To save the current spectrum, press “Memory”, “Spectrum” and the memory location to be used is displayed at the lower right of the TFT screen. There are 99 memory positions available which can be selected using the knob. When the desired location is displayed, press “Save” to save the spectrum. Positions are marked to show if they are “used” or “free”.

Memory -> Spectrum -> Load) This loads a saved spectrum for review or processing. To load a saved spectrum, press “Memory”, “Spectrum”, and the memory location to be loaded is displayed on the TFT screen at the lower right. When the desired memory location is selected using the knob, press “Load” to show the saved spectrum.

Memory -> Spectrum -> Delete) This deletes a memory position. To delete a memory position, use the knob to select the memory position as displayed on the TFT screen at the lower right. Once the desire memory location is selected, press “Delete” and the memory position is now “free”.

Memory -> Usr span -> Save) This saves the current spectrum settings of marker frequency and span so that sections of the spectrum can be easily recalled by using the “Usr span” function on the TV Spectrum menu. When a desired spectrum presentation is displayed, press ”Memory -> Usr span -> Save” and choose the memory position 1-8 to save this User Span.

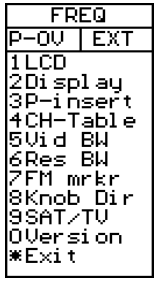
Memory -> Usr span -> Delete) This deletes a User Span setting. Choose the User Span to delete.

Picture -> Memory -> Save) When a TV channel is selected, it can be saved as a favourite channel so that it can be easily selected. When the correct channel is displayed in the Picture mode, press “Memory” and then use the knob to select the memory location to

store the channel frequency. Displayed at the bottom of the LCD screen. The LCD display will either show that the memory location is “Used” and show the channel number or will show the memory location is “Free”. Press “Save” to save the frequency data. This is now a favourite and can be selected by the knob when in “FAVORITE” mode. (When in picture mode, the knob is first in “FREQ” mode so that the knob will change the frequency. One push of the knob button changes the knob mode to “CHANNEL” mode and turning the knob selects the channel using the current channel table. One more press of the knob button changes the knob mode to “FAVORITE” and the saved favourite channels are selected by turning the knob.)

Picture -> Memory -> Delete) To delete a previously saved Favorite channel, press “Memory” and use the knob to select the Favorite channel to delete, and the press “Delete”.

Setup (TV)



The setup menu contains the items which are infrequently used.

Lcd) The LCD contrast can be adjusted and the LCD backlight enabled or disabled.

Display) The scan cursor in the TV spectrum can be enabled or disabled. The Spectrum Graticule can be turned on for dB guidelines. The display units for signal level can be set to dBuV, dBm, or dBmV. The TV Level can be adjusted from 55 dB to 75 dB. This is the level that the Combolook uses for automatic attenuation for TV presentation.

P-insert) The supply voltage on the antenna can be selected when using an active antenna. Ensure you know the correct operating voltage of the antenna amplifier because supplying too high a voltage could burn out the active device. The voltage can be adjusted from 0V (off) to between 12DCV and 24DCV. The positive supply is the BNC Center terminal. The selected output voltage is always visible in upper left hand of the LCD display (next to the battery-symbol). The default setting of “P – insert” is “Off” (0 volt). Warning ! Misuse of this function may cause irreparable damage to all connected equipment not intended to accept or receive voltage !

CH_Table) This selects the Channel Table in use to display and select the frequency. The available channel tables are: CCIT, France, Poland, Italy, UK1, UK2, UK3, South Africa, and Australia. Details for these channel tables are shown in Appendix E.

Vid BW) The Video filter is placed after the measuring chip-set in the instrument, and is used in conjunction with various resolutions within a specified bandwidth. The resolution of details on a signal-carrier is progressively refined in relation to the narrowing of a filter (sweep-time is increased). The different Video filters are: auto-mode (default), 100 kHz, 10 kHz, 1 kHz or 100 Hz.

Res BW) The resolution bandwidth shows the incoming signal before the measuring chip-set in the instrument. Choose between the narrow 300 kHz or the wider 1 MHz resolution. The instrument is normally working in the ”auto” mode.

AM Marker) Choose between FM or AM marker. FM = Normal spectrum measuring. AM = Peak spectrum measuring which is preferable when measuring TV signals due to the speed at which calculations are processed.

SAT/TV) The instrument mode when turned on can be selected to start either in TV mode or Satellite mode. A third option is available which will ask the user on startup to select the mode. If no selection is made within 20 seconds, the instrument will turn off.

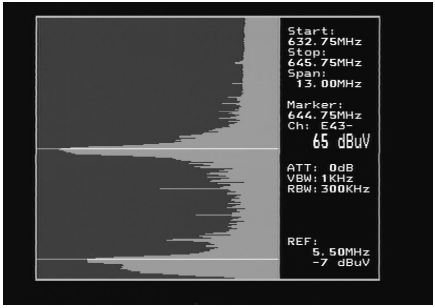
Version) The version menu displays serial number, levels of the firmware and related information.

Signal-to-Noise Ratio Measurements (TV)

The Combolook Color HD is capable of performing measurements of the Signal/Noise or Picture-Carrier/Audio-Carrier ratio.

To perform these measurements:

- Put the marker on any signal carrier and ”zoom in” with the ”Span 13 ” button.
- Push Ref mrkr, for the reference marker setting.
- Tune in the ”right” frequency with the marker so that it is a the peak of the signal to measure.
- Push Ref set and a new marker appears on top of the first marker.
- Turn the knob and place the reference marker on another carrier (signal peak), or on the noise-floor.
- The relation between the first marker and the second marker is presented in the lower right hand corner of the picture-screen so in the spectrum below we see that the audio carrier is 7dBuV lower that the picture carrier and the video/audio carrier spacing is 5.5MHz.



This measurement can also be made from Spectrum samples saved in memory. After a spectrum is loaded from memory with “Memory -> Load” choose” Ref mrkr” and use the knob and set the first marker position with “Ref set” and then use the knob to define the second reference marker.

Channel Power Measurement (TV)

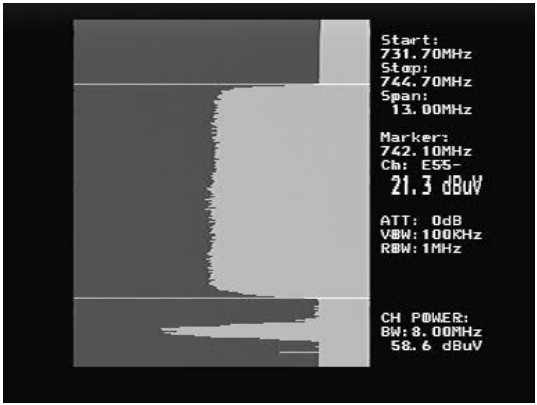
The digital output-level (in dB) of digital transponders (such as in digital terrestrial transmissions) can be measured for saved spectrum samples.

(If the spectrum is not saved, then save the spectrum to a memory location by “Memory -> Spectrum -> Save”)

Load a saved spectrum using “Memory -> Spectrum” and use the knob to select the memory position and then press “Load”.

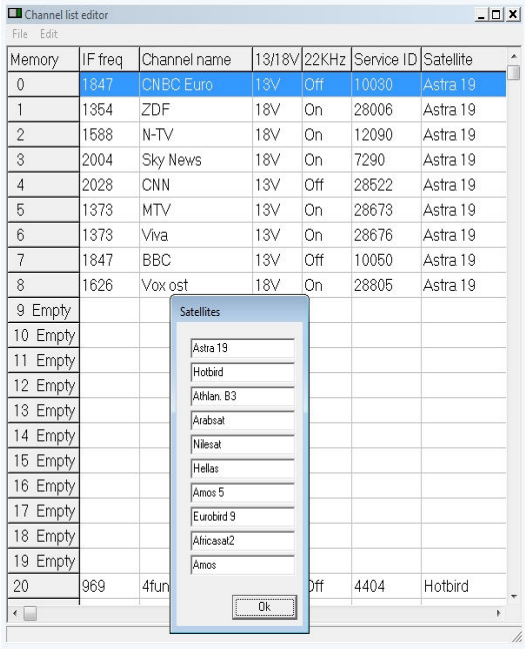
Press “Digital” and now use the knob to set the start frequency of the digital channel. Press “Set strt” and then use the knob to set the stop frequency and press “Set strt” again. (Digital transponders are normally 8 MHz wide)

The channel power and bandwidth are shown at the lower right of the TFT screen.



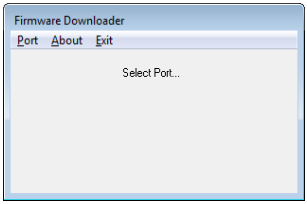
Using PC to transfer transponder data

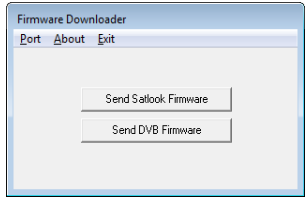
Satellite transponder data can be loaded from the instrument to and from a PC for easy changes. The Windows PC program used is chedit.exe. From the File Menu, a channel file can be loaded from the Combolook, edited and saved back to the Combolook. Also channel files can be loaded and saved on the PC for backup and easy updates of channel files.



Loading Firmware

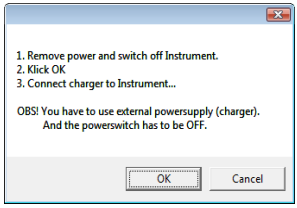
Loading new firmware to the Combolook is done using a Windows loader program called “FDLDVB.exe”. Also needed is the firmware hex file to load. In the Combolook, there are two different types of firmware used. The main control firmware will have a name like “CL-HD-10” and the DVB module firmware has a name like “SC_DVB_1.3.bin”. Usually it will be necessary to only update the main control firmware. Do not load any firmware without these types of name, it will be for a different instrument and will not work on the Combolook Color HD. Use the Version screen in the Setup Menu to determine the current software version.
In order to load firmware, you must have a PC which supports an RS232 connection. The firmware loading must be performed with the external charger connected. The RS232 cable to be used is supplied as part of the kit with the Combolook Color HD. Some laptops do not have an RS232 connection, but a USB to RS232 adapter can be purchased at low cost. Connect the Rs232 cable from the computer to the instrument. Run the firmware download file “FDLDVB.exe”.

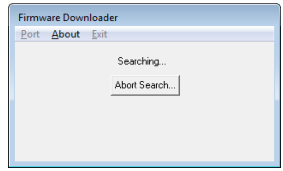


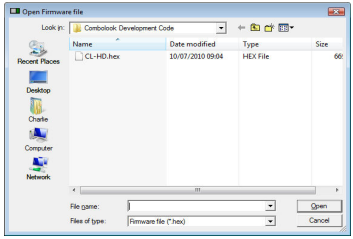


Select the RS232 port on the computer. Normally, the port is COM1 but some USB to RS232 will use some other port. If desirable, this USB to RS232 conversion device can be made to always use COM1 by clicking Control Panel / Device Manager / Ports and in the Advanced settings for the adapter set to COM1.

Select “Send Satlook Firmware” and then “OK” and the display will show “Searching”. Connect the Combolook Color S2/T2 to the external charger and the display will change to a file dialog to choose the firmware file.

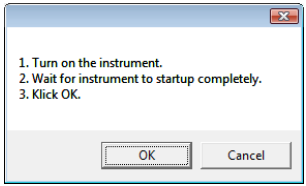

1. Remove power and switch off Instrument.
2. Klick OK
3. Connect charger to Instrument...
OBS! You have to use external powersupply (charger).
And the powerswitch has to be OFF.
OK
Cancel

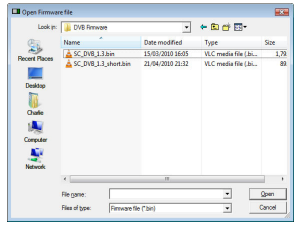




Normally, the firmware will be in the same direction as “FDLDVB.exe” but if not, you can navigate to the correct directory and select the firmware file. Once the file is selected, the firmware loading will take about 10 minutes and then the Firmware Downloader program will display “Download Complete”.

The DVB module firmware will probably not need updating, but if it does, then choose the “Send DVB Firmware”. The loading process for this firmware is different. Power on the Combolook and wait until it is fully started.





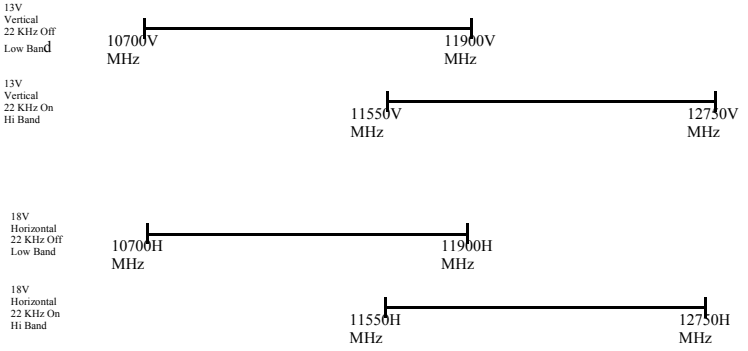
Once a firmware file is selected, download will begin and take about 25 minutes.

Appendix A – Universal LNB Primer

The LNB (low noise block amplifier) has evolved since its early introduction in Satellite broadcasting. Signals broadcast from satellites are 10600 MHz to 12700 MHz for Ku band and 3000 MHz to 4500 MHz for C band. Because the losses in coax are quite high for these frequencies, the satellite signal is first downconverted to a more manageable 950 MHz to 2150 MHz for transmission from the dish to the receiver. This is called the IF (intermediate frequency) or also the L Band. Most of the European broadcasting is in the Ku band. The satellite transmission can use either horizontal or vertical polarisation. This is a way of re-using the available spectrum since there can be two transponders at the same frequency with different polarisations. The Universal LNB can receive either horizontal or vertical polarisations depending on the LNB line voltage. 13V is used to select Vertical polarisation and 18V is used to select Horizontal polarisation.

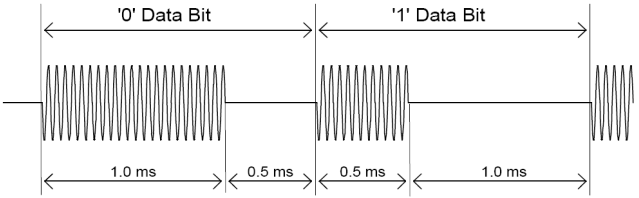
The Ku band for satellite reception is 2100 MHz wide (12700 – 10600) while the receiver input is only 1100 MHz wide (2150 – 950). To allow the full reception of the entire Ku band, two different local oscillator (LO) frequencies are used in the Universal LNB. This LO frequency is switched in the Universal LNB by using the 22 KHz tone. When it is off, then the LO frequency used is 9750 MHz and when on, 10600 MHz is used.

The four frequency ranges for the Universal LNB are sometimes called quadrants and is diagrammed below showing the overlap.



Appendix B – DiSEqC Primer

About DiSEqC
DiSEqC is an acronym for “Digital Satellite Equipment Control” and is achieved using the 22kHz signalling tone. The 22 kHz signal is imposed on the LNB DC voltage of 13V or 18V at a level of 0.65V p-p. Normally, the 22kHz signal is either continuously on or off. When a DiSEqC message is to be sent, if the 22kHz is on, it is turned off for a “quiet period” before the message. Then the DiSEqC message is sent as a series of bytes with an odd parity bit appended. The bits are formed by modulation of the 22kHz signal as shown below.



Most DiSEqC commands are 3 bytes in length but some can be up to 6 bytes long, so the transmission time of a DiSEqC message is on the order of 40 to 80 milliseconds.

DiSEqC Commands
LNB1: 0xe0, 0x10, 0x38, 0xc0
LNB2: 0xe0, 0x10, 0x38, 0xc4
LNB3: 0xe0, 0x10, 0x38, 0xc8
LNB4: 0xe0, 0x10, 0x38, 0xcc
SW1: 0xe0, 0x10, 0x39, 0xf0
SW2: 0xe0, 0x10, 0x39, 0xf1
SW3: 0xe0, 0x10, 0x39, 0xf2
SW4: 0xe0, 0x10, 0x39, 0xf3
SW5: 0xe0, 0x10, 0x39, 0xf4
SW6: 0xe0, 0x10, 0x39, 0xf5
SW7: 0xe0, 0x10, 0x39, 0xf6
SW8: 0xe0, 0x10, 0x39, 0xf7
SW9: 0xe0, 0x10, 0x39, 0xf8
SW10: 0xe0, 0x10, 0x39, 0xf9
SW11: 0xe0, 0x10, 0x39, 0xfa
SW12: 0xe0, 0x10, 0x39, 0xfb
SW13: 0xe0, 0x10, 0x39, 0xfc
SW14: 0xe0, 0x10, 0x39, 0xfd
SW15: 0xe0, 0x10, 0x39, 0xfe
SW16: 0xe0, 0x10, 0x39, 0xff
TBA: Tone Burst 0 to select satellite A
TBB: Tone Burst 1 to select satellite B

Go East: 0xe0, 0x31, 0x68, 0x1e
Go Home: 0xe0, 0x31, 0x6b, 0x00
Go West: 0xe0, 0x31, 0x69, 0x1e
Set East: 0xe0, 0x31, 0x66
Clr Lim: 0xe0, 0x31, 0x63
Set West: 0xe0, 0x31, 0x67
Goto Pos: 0xe0, 0x31, 0x6b, <Position Number 1 to 31>
Save Pos: 0xe0, 0x31, 0x6a, <Position Number 1 to 31>
Goto X: 0xe0, 0x31, 0x6e, <Movement High Byte>, <Movement Low Byte>

For the full DiSEqC specifications, see http://www.eutelsat.com/satellites/4_5_5.html)

Appendix C DVB-S and DVB-S2 Primer

DVB-S and DVB-S2 both use phase shift keying to digitally modulate a carrier. Quadrature phase shift keying is used in both and the digital data is encoded as a 90 degree phase shift in the signal. This gives 4 possible states for each sampling interval. The sampling interval is called the Symbol Rate and each state of 2 bits is a Symbol. During transmission, this data is interleaved to allow recovery during noise bursts and redundant data is added called FEC (forward error correction). During reception, the data is re-shuffled to restore the order and the FEC data is used to correct the bitstream as necessary. In DVB-S2, 8PSK (octal phase shift keying) can be used in transmission where there are 8 possible states from a 45 degree phase shift in the Analog signal. A different scrambling and FEC for DVB-S2 allows better noise immunity.

The bitstream output for both DVB-S and DVB-S2 is the same. This bitstream is called "transport stream". A transport stream is made up of packets. All packets are the same length of 188 bytes and they all start with the sync byte 0x47 so that when the data is read, a starting point can be located. Each packet also contains a PID (packet identification). The information in the transport stream consists of several video and audio streams and also SI tables (Service Information) to allow the receiver to decode and display the correct data. There are several types of tables in the SI called PSI data. This table data is generally longer than one packet so several packets are assembled together to make a "section" which can be up to 1024 bytes.

1) Program Association Table (PAT): for each service in the multiplex, the PAT indicates the PID of the corresponding Program Map Table (PMT). It also gives the location of the Network Information Table (NIT).

2) Program Map Table (PMT): the PMT identifies and indicates the PIDs of the video, audio, and other streams that make up each service.

3) Network Information Table (NIT): the NIT gives the Network Number, Name and Satellite Position of the satellite. It also lists all the other transponders on the satellite.

4) Service Description Table (SDT): the SDT gives information about each service in this transport stream.

Once these tables are decoded by the receiver, the correct PID for the audio and video streams can be found and presented to the video and audio decoders. In DVB-S, the video streams are presented in MPEG-1 or MPEG-2 encoding (usually MPEG-2). For DVB-S2, the video streams can be presented in these formats or in the newer HD format MPEG-4.

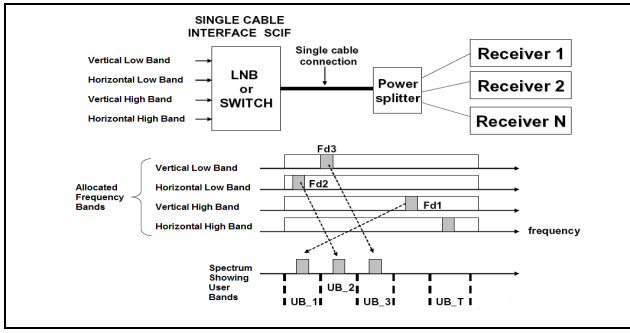
(For a more complete understanding, see ISO 13818-1 "Information technology, Generic coding of moving pictures and associated audio information: Systems" and DVB EN 300 468 "Specification for Service Information")

Appendix D SatCR Primer

SatCR (UniCable) or SCIF (Single Cable Interface) is a method of translating Satellite frequencies from the LNB to the user. It is intended to allow multiple receivers to share the same coaxial cable.

With a standard Universal LNB, with Horizontal and Vertical polarity and low and high band, there are four frequency ranges that can be selected from the LNB by using the 13V/18V and the 22kHz signal. In order to allow multiple receivers to operate using a single coax cable, UniCable operation requires the receiver to send the desired frequency using a DiSEqC command. A SatCR LNB or Switch may be used. For a SatCR Switch, the LNB input is usually a Quattro LNB which provides the four frequency ranges to the switch. For a SatCR LNB, the Switch and the Quattro LNB are integral.

To tune a frequency on the SatCR LNB (or Switch), the receiver issues a DiSEqC command which indicates the Satellite Frequency needed, the Polarisation, the Band and what User Band to use. The number of User bands differs but normal is 4 or 8.



The User Bands which are available can be determined by sending a DiSEqC command to emit RF tones at the centre frequencies of the User bands. By scanning the frequencies, the User Bands are located. To find out what number User Band this is, another DiSEqC command is sent to turn off the tone at User Band XX. By selectively turning the RF tones off, the number of the User Band is determined. Alternatively, The User Band Frequency allocation is usually provided on the LNB/Switch description. The placement of the User bands within the spectrum is not the same between manufacturers.

For further detail on SatCR, see the specification EN 50494 – Satellite signal distribution over a single coaxial cable in single dwelling installations.

SatCR Commands: (only the 5 byte commands are shown)

ODU_Power_OFF: (0xe0 0x00 0x5a D1 0x00)
Turn power off for the selected User Band.
D1 is defined as bit 5,6,7 select the User Band and bit 0,1,2,3,4 = 0;

ODU_UBxSignal_ON: (0xe0 0x00 0x5b 0x00 0x00)
Generate an RF tone at the centre of each User Band.

ODU_Config: (0xe0 0x00 0x5b D1 D2)
D1 is defined as bit 5,6,7 select the User Band and bit 0 = 1, bit 1,2,3,4 = 0;
Generate an RF tone answer at the selected User Band for the question in D2

ODU_LoFreq: (0xe0 0x00 0x5b D1 D2)
D1 is defined as bit 5,6,7 select the User Band and bit 1 = 1, bit 0,2,3,4 = 0;
Generate an RF tone answer at the selected User Band for the question in D2

ODU_Channel_change (0xe0 0x00 0x5a D1 D2)
D1 is defined as D1 is defined as bit 5,6,7 select the User Band, bit 3 selects polarisation, bit 2 selects low/high band, bits 0,1 of D1 and D2 are 10 bit Tuning Word.

$$TuningWord = \left(F_{Satellite} - F_{LO} + F_{UserBand}\right)/4 - 350$$

Appendix E – Television Channel Tables

CCIR Channels

E2	48.25 MHz	S24	327.25 MHz	E42
E3	55.25 MHz	S25	335.25 MHz	E43
E4	62.25 MHz	S26	343.25 MHz	E44
		S27	351.25 MHz	E45
S01	69.25 MHz	S28	359.25 MHz	E46
S02	76.25 MHz	S29	367.25 MHz	E47
S03	83.25 MHz	S30	375.25 MHz	E48
S1	105.25 MHz	S31	383.25 MHz	E49
S2	112.25 MHz	S32	391.25 MHz	E50
S3	119.25 MHz	S33	399.25 MHz	E51
S4	126.25 MHz	S34	407.25 MHz	E52
S5	133.25 MHz	S35	415.25 MHz	E53
S6	140.25 MHz	S36	423.25 MHz	E54
S7	147.25 MHz	S37	431.25 MHz	E55
S8	154.25 MHz	S38	439.25 MHz	E56
S9	161.25 MHz	S39	447.25 MHz	E57
S10	168.25 MHz	S40	455.25 MHz	E58
		S41	463.25 MHz	E59
E5	175.25 MHz			E60
E6	182.25 MHz	E21	471.25 MHz	E61
E7	189.25 MHz	E22	479.25 MHz	E62
E8	196.25 MHz	E23	487.25 MHz	E63
E9	203.25 MHz	E24	495.25 MHz	E64
E10	210.25 MHz	E25	503.25 MHz	E65
E11	217.25 MHz	E26	511.25 MHz	E66

E12	224.25 MHz	E27	519.25 MHz	E67
		E28	527.25 MHz	E68
S11	231.25 MHz	E29	535.25 MHz	E69
S12	238.25 MHz	E30	543.25 MHz	E70
S13	245.25 MHz	E31	551.25 MHz	E71
S14	252.25 MHz	E32	559.25 MHz	E72
S15	259.25 MHz	E33	567.25 MHz	E73
S16	266.25 MHz	E34	575.25 MHz	E74
S17	273.25 MHz	E35	583.25 MHz	E75
S18	280.25 MHz	E36	591.25 MHz	
S19	287.25 MHz	E37	599.25 MHz	
S20	294.25 MHz	E38	607.25 MHz	
S21	303.25 MHz	E39	615.25 MHz	
S22	311.25 MHz	E40	623.25 MHz	
S23	319.25 MHz	E41	631.25 MHz	

France

L02	55.75 MHz	E40	623.25 MHz
L03	60.50 MHz	E41	631.25 MHz
L04	63.75 MHz	E42	639.25 MHz
		E43	647.25 MHz
L05	176.00 MHz	E44	655.25 MHz
L06	184.00 MHz	E45	663.25 MHz
L07	192.00 MHz	E46	671.25 MHz
L08	200.00 MHz	E47	679.25 MHz
L09	208.00 MHz	E48	687.25 MHz
L10	216.00 MHz	E49	695.25 MHz
		E50	703.25 MHz
E21	471.25 MHz	E51	711.25 MHz
E22	479.25 MHz	E52	719.25 MHz
E23	487.25 MHz	E53	727.25 MHz
E24	495.25 MHz	E54	735.25 MHz
E25	503.25 MHz	E55	743.25 MHz
E26	511.25 MHz	E56	751.25 MHz
E27	519.25 MHz	E57	759.25 MHz
E28	527.25 MHz	E58	767.25 MHz
E29	535.25 MHz	E59	775.25 MHz
E30	543.25 MHz	E60	783.25 MHz
E31	551.25 MHz	E61	791.25 MHz
E32	559.25 MHz	E62	799.25 MHz
E33	567.25 MHz	E63	807.25 MHz
E34	575.25 MHz	E64	815.25 MHz
E35	583.25 MHz	E65	823.25 MHz

E36	591.25 MHz	E66	831.25 MHz
E37	599.25 MHz	E67	839.25 MHz
E38	607.25 MHz	E68	847.25 MHz
E39	615.25 MHz	E69	855.25 MHz

Poland

S01	111.25 MHz	S26	367.25 MHz	K40
S02	119.25 MHz	S27	375.25 MHz	K41
S03	127.25 MHz	S28	383.25 MHz	K42
S04	136.25 MHz	S29	391.25 MHz	K43
S05	143.25 MHz	S30	399.25 MHz	K44
S06	151.25 MHz	S31	407.25 MHz	K45
S07	159.25 MHz	S32	416.25 MHz	K46
S08	167.25 MHz	S33	423.25 MHz	K47
K05	176.25 MHz	S34	431.25 MHz	K48
K07	183.25 MHz	S35	439.25 MHz	K49
K08	191.25 MHz	S36	447.25 MHz	K50
K09	199.25 MHz	S37	455.25 MHz	K51
K10	207.25 MHz	S38	463.25 MHz	K52
K11	215.25 MHz	K21	471.25 MHz	K53
K12	223.25 MHz	K22	479.25 MHz	K54
S09	231.25 MHz	K23	487.25 MHz	K55
S10	239.25 MHz	K24	495.25 MHz	K56
S11	247.25 MHz	K25	503.25 MHz	K57
S12	255.25 MHz	K26	511.25 MHz	K58
S13	263.25 MHz	K27	519.25 MHz	K59
S14	271.25 MHz	K28	527.25 MHz	K60
S15	279.25 MHz	K29	535.25 MHz	K61
S16	287.25 MHz	K30	543.25 MHz	K62
S17	295.25 MHz	K31	551.25 MHz	K63

S18	303.25 MHz	K32	559.25 MHz	K64
S19	311.25 MHz	K33	567.25 MHz	K65
S20	319.25 MHz	K34	576.25 MHz	K66
S21	327.25 MHz	K35	583.25 MHz	K67
S22	336.25 MHz	K36	591.25 MHz	K68
S23	343.25 MHz	K37	599.25 MHz	K69
S24	351.25 MHz	K38	607.25 MHz	
S25	359.25 MHz	K39	615.25 MHz	

Italy

A	53.75 MHz	43	647.25 MHz
B	62.25 MHz	44	655.25 MHz
C	82.25 MHz	45	663.25 MHz
D	175.25 MHz	46	671.25 MHz
E	183.75 MHz	47	679.25 MHz
F	192.25 MHz	48	687.25 MHz
G	201.25 MHz	49	695.25 MHz
H	210.25 MHz	50	703.25 MHz
H1	217.25 MHz	51	711.25 MHz
H2	224.25 MHz	52	719.25 MHz
		53	727.25 MHz
21	471.25 MHz	54	735.25 MHz
22	479.25 MHz	55	743.25 MHz
23	487.25 MHz	56	751.25 MHz
24	495.25 MHz	57	759.25 MHz
25	503.25 MHz	58	767.25 MHz
26	511.25 MHz	59	775.25 MHz
27	519.25 MHz	60	783.25 MHz
28	527.25 MHz	61	791.25 MHz
29	535.25 MHz	62	799.25 MHz
30	543.25 MHz	63	807.25 MHz
31	551.25 MHz	64	815.25 MHz
32	559.25 MHz	65	823.25 MHz
33	567.25 MHz	66	831.25 MHz
34	575.25 MHz	67	839.25 MHz
35	583.25 MHz	68	847.25 MHz

36	591.25 MHz	69	855.25 MHz
37	599.25 MHz	70	863.25 MHz
38	607.25 MHz	71	871.25 MHz
39	615.25 MHz	72	879.25 MHz
40	623.25 MHz	73	887.25 MHz
41	631.25 MHz	74	895.25 MHz
42	639.25 MHz	75	903.25 MHz

UK 1

B1	45.00 MHz	41	631.25 MHz
B2	51.75 MHz	42	639.25 MHz
B3	56.75 MHz	43	647.25 MHz
B4	61.75 MHz	44	655.25 MHz
B5	66.75 MHz	45	663.25 MHz
B6	179.75 MHz	46	671.25 MHz
B7	184.75 MHz	47	679.25 MHz
B8	189.75 MHz	48	687.25 MHz
B9	194.75 MHz	49	695.25 MHz
B10	199.75 MHz	50	703.25 MHz
B11	204.75 MHz	51	711.25 MHz
B12	209.75 MHz	52	719.25 MHz
B13	214.75 MHz	53	727.25 MHz
B14	219.75 MHz	54	735.25 MHz
		55	743.25 MHz
21	471.25 MHz	56	751.25 MHz
22	479.25 MHz	57	759.25 MHz
23	487.25 MHz	58	767.25 MHz
24	495.25 MHz	59	775.25 MHz
25	503.25 MHz	60	783.25 MHz
26	511.25 MHz	61	791.25 MHz
27	519.25 MHz	62	799.25 MHz
28	527.25 MHz	63	807.25 MHz
29	535.25 MHz	64	815.25 MHz
30	543.25 MHz	65	823.25 MHz
31	551.25 MHz	66	831.25 MHz

32	559.25 MHz	67	839.25 MHz
33	567.25 MHz	68	847.25 MHz
34	575.25 MHz	69	855.25 MHz
35	583.25 MHz	70	863.25 MHz
36	591.25 MHz	71	871.25 MHz
37	599.25 MHz	72	879.25 MHz
38	607.25 MHz	73	887.25 MHz
39	615.25 MHz	74	895.25 MHz
40	623.25 MHz	75	903.25 MHz

UK 2

1	120.00 MHz	28	336.00 MHz
2	128.00 MHz	29	344.00 MHz
3	136.00 MHz	30	352.00 MHz
4	144.00 MHz	31	360.00 MHz
5	152.00 MHz	32	368.00 MHz
6	160.00 MHz	33	376.00 MHz
7	168.00 MHz	34	384.00 MHz
8	176.00 MHz	35	392.00 MHz
9	184.00 MHz	36	400.00 MHz
10	192.00 MHz	37	408.00 MHz
11	200.00 MHz	38	416.00 MHz
12	208.00 MHz	39	424.00 MHz
13	216.00 MHz	40	432.00 MHz
14	224.00 MHz	41	440.00 MHz
15	232.00 MHz	42	448.00 MHz
16	240.00 MHz	43	456.00 MHz
17	248.00 MHz	44	464.00 MHz
18	256.00 MHz	45	472.00 MHz
19	264.00 MHz	46	480.00 MHz
20	272.00 MHz	47	488.00 MHz
21	280.00 MHz	48	496.00 MHz
22	288.00 MHz	49	504.00 MHz
23	296.00 MHz	50	512.00 MHz
24	304.00 MHz	51	520.00 MHz
25	312.00 MHz	52	528.00 MHz
26	320.00 MHz	53	536.00 MHz
27	328.00 MHz	54	544.00 MHz

UK 3

A	55.25 MHz
2	135.25 MHz
3	159.25 MHz
4	175.25 MHz
5	183.25 MHz
6	191.25 MHz
7	199.25 MHz
8	207.25 MHz
9	215.25 MHz
10	223.25 MHz
11	231.25 MHz
12	247.25 MHz
13	255.25 MHz
14	263.25 MHz
15	271.25 MHz
16	279.25 MHz
17	287.25 MHz
18	295.25 MHz
19	319.25 MHz
20	343.25 MHz
21	351.25 MHz
22	359.25 MHz
23	367.25 MHz
24	375.25 MHz
25	383.25 MHz
26	391.25 MHz

27	399.25 MHz
28	415.25 MHz
29	423.25 MHz
30	431.25 MHz
U21	471.25 MHz
U22	479.25 MHz
U23	487.25 MHz
U24	495.25 MHz
U25	503.25 MHz
U26	511.25 MHz
U27	519.25 MHz
U28	527.25 MHz
U29	535.25 MHz
U30	543.25 MHz

South Africa

4	175.25 MHz	43	647.25 MHz
5	183.25 MHz	44	655.25 MHz
6	191.25 MHz	45	663.25 MHz
7	199.25 MHz	46	671.25 MHz
8	207.25 MHz	47	679.25 MHz
9	215.25 MHz	48	687.25 MHz
10	223.25 MHz	49	695.25 MHz
11	231.25 MHz	50	703.25 MHz
12	239.25 MHz	51	711.25 MHz
13	247.25 MHz	52	719.25 MHz
		53	727.25 MHz
21	471.25 MHz	54	735.25 MHz
22	479.25 MHz	55	743.25 MHz
23	487.25 MHz	56	751.25 MHz
24	495.25 MHz	57	759.25 MHz
25	503.25 MHz	58	767.25 MHz
26	511.25 MHz	59	775.25 MHz
27	519.25 MHz	60	783.25 MHz
28	527.25 MHz	61	791.25 MHz
29	535.25 MHz	62	799.25 MHz
30	543.25 MHz	63	807.25 MHz
31	551.25 MHz	64	815.25 MHz
32	559.25 MHz	65	823.25 MHz
33	567.25 MHz	66	831.25 MHz
34	575.25 MHz	67	839.25 MHz
35	583.25 MHz	68	847.25 MHz

36	591.25 MHz	69	855.25 MHz
37	599.25 MHz	70	863.25 MHz
38	607.25 MHz	71	871.25 MHz
39	615.25 MHz	72	879.25 MHz
40	623.25 MHz	73	887.25 MHz
41	631.25 MHz	74	895.25 MHz
42	639.25 MHz	75	903.25 MHz

Australia

0	46.25 MHz	39	604.25 MHz
1	57.25 MHz	40	611.25 MHz
2	64.25 MHz	41	618.25 MHz
3	86.25 MHz	42	625.25 MHz
4	95.25 MHz	43	632.25 MHz
5	102.25 MHz	44	639.25 MHz
5A	138.25 MHz	45	646.25 MHz
6	175.25 MHz	46	653.25 MHz
7	182.25 MHz	47	660.25 MHz
8	189.25 MHz	48	667.25 MHz
9	196.25 MHz	49	674.25 MHz
10	209.25 MHz	50	681.25 MHz
11	216.25 MHz	51	688.25 MHz
12	224.25 MHz	52	695.25 MHz
21	478.25 MHz	53	702.25 MHz
22	485.25 MHz	54	709.25 MHz
23	492.25 MHz	55	716.25 MHz
24	499.25 MHz	56	723.25 MHz
25	506.25 MHz	57	730.25 MHz
26	513.25 MHz	58	737.25 MHz
27	520.25 MHz	59	744.25 MHz
28	527.25 MHz	60	751.25 MHz
29	534.25 MHz	61	758.25 MHz
30	541.25 MHz	62	765.25 MHz
31	548.25 MHz	63	772.25 MHz
32	555.25 MHz	64	779.25 MHz

33	562.25 MHz	65	786.25 MHz
34	569.25 MHz	66	793.25 MHz
35	576.25 MHz	67	800.25 MHz
36	583.25 MHz	68	807.25 MHz
37	590.25 MHz	69	814.25 MHz
38	597.25 MHz		

Appendix F – DVB-T/T2 Principles

DVB-T uses OFDM (orthogonal frequency division multiplex) modulation. This type of modulation, which uses a large number of sub-carriers, delivers a robust signal that has the ability to deal with very severe channel conditions. The DVB-T standard has technical characteristics that make it a very flexible system: 3 modulation options (QPSK, 16QAM, 64QAM), 5 different FEC rates, 4 Guard Interval options, 2k or 8k carriers (actually this is 1705 carriers or 6817 carriers), 6, 7 or 8MHz channel bandwidths

One other technical aspect of DVB-T is its capacity for Hierarchical Modulation. Using this technique, two completely separate data streams are modulated onto a single DVB-T signal. A "High Priority" (HP) stream is embedded within a "Low Priority" (LP) stream.

Typically, the LP stream is of higher bitrate, but lower robustness than the HP one. Receivers with "good" reception conditions can receive both streams, while those with poorer reception conditions may only receive the "High Priority"stream.

After the MPEG transport stream (usually called MUX instead of transport stream) is demodulated, then the data encoding is the same as DVB-S as explained in Appendix C.

For further information see the DVB-T Standard published as EN 300 744 and ETSI TS 101 154, Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream.

The DVB-T2 specification.
The DVB-T2 draft standard was ratified by the DVB Steering Board on June 26, 2008.
The ETSI process resulted in the DVB-T2 standard being adopted on September 9, 2009.

System differences with DVB-T .

	DVB-T	DVB-T2
Forward Error Correction (FEC)	Convolutional Coding + Reed Solomon 1/2, 2/3, 3/4, 5/6, 7/8	LDPC + BCH 1/2, **3/5**, 2/3, 3/4, **4/5**, 5/6
Modulations	QPSK, 16QAM, 64QAM	QPSK, 16QAM, 64QAM, **256QAM**
Guard Interval	1/4, 1/8, 1/16, 1/32	1/4, **19/256**, 1/8, **19/128**, 1/16, 1/32, 1/128
Discrete Fourier Transform size	2k, 8k	**1k**, 2k, **4k**, 8k, **16k**, **32k**

The table above reports a comparison of available modes in DVB-T and DVB-T2.

Appendix G- Maintenance

The instrument is equipped with a rechargeable battery and it is important that the battery is maintained. Recharging should be done using the included car adaptor or external power supply. (110-220V/14V DC, center-pin positive and chassis earth)

Please note that instrument can be operated, for shorter periods of time, by the external power supply, however, the Combolook Color HD is not made for permanent operation with the external power supply. This will degrade the battery. Contact your dealer for more information.

Adjustments for vertical hold, brightness and contrast are located under the instrument. Contact your dealer for proper adjustments.

The battery needs recharging when the battery symbol at the top of the LCD appears empty. For protection of the battery, when the battery voltage falls to an unsafe level, "BATTERY EMPTY" is displayed on the LCD and then the instrument turns off. Remember that a cold battery has much lower capacity than one at room temperatures. The Combolook Color HD is designed for outside use in rough conditions but it should not be exposed to rain or snow as this can damage or shorten the lifetime of the instrument.

Checking/charging the battery:
Because the instrument has been stored for some time before transportation it is important to check the battery-condition. To do this turn the main switch On.
When starting the instrument, the LCD color monitor and LCD display turns On.
There is a battery symbol at the top of the LCD display that shows the status of the battery. All black means that the battery is fully charged. If the symbol is empty it means that the battery is nearly completely discharged.

If the battery needs recharging, use the power supply included with the instrument.
A thermometer scale (0-100%) is displayed on the LCD as the recharging starts.
Please note that the instrument should be turned off when being recharged. Charging will not be performed with the instrument is on. Recharging from fully discharged battery to about 98% capacity takes approximately 30 hours. When the battery been recharged the Combolook Color HD is ready to be used.

Appendix H – Specification

Satellite TV (uses SAT-IN F-Connector)
Input frequency: 920-2150MHz
Min Input Level: About 35 dBuV (noiselevel).
Max Input Level: About 90 dBuV.
Attenuation: 15 dB manual attenuator on/off.
Accuracy: ±1½ dB TV Accuracy: ±1dB (at +20 C)
Spectrum bandwidth from 250MHz to 1230MHz
Frequency display: Yes, IF default. All standard LNB LO can be used
Display of signal level (Analog): dB-level on Spectrum display
Pitch-tone on loudspeaker for dish/antenna signal strength optimisation
Display of signal level (Digital): SNR (signal/noise-ratio), BER (bit error rate), MER
Constellation diagram (DVB-S, DVB-S2, QPSK, 8PSK normal, 8PSK rotated)
Symbol rate display: 1 to 45 MSymbols/sec
Satellite identification: Yes, NIT display (Network Information Table) according to the DVB standard. Identifies Satellite Name and position. Name of TV and radio channels from SDT (Service Description Table)
Digital DVB-S, MPEG2 FTA reciever. (DVB-S/2, MPEG-4 not decoded)
Ku - C-band: Yes, selectable from LNB type defined.
Audio bandwidth : Adjustable between 5.5 MHz and 8.5 MHz
Memory: -100 spectrum pictures can be stored with name.
Stored spectrum can be mixed for easy identification of satellite.
Maxhold function.
Power out: Yes, 13-18V for LNB can be adjusted.
22 kHz tone: Yes, on/off.
DiSEqC Yes, all 1.0 and 1.1. Also Toneburst on/off.
DiSEqC actuator: Built in positioner for DiSEqC 1.2, SatScan and SatSelect.
DiSEqC Goto X for USALS operation.

TV/CATV (uses TV-IN F-Connector)
Input Frequency: 2–900MHz
Min Input Level: About 35 dBuV (noiselevel).
Max Input Level: Picture = 110 dBuV Spectrum = 120 dBuV
Attenuation: 0dB to 45dB in 1 dB step (Automatic or manual setting)
Accuracy: ±1dB (at +20 C)
Resolution Bandwidth: 1MHz or 300kHz
Video Bandwidth: 100kHz, 1-kHz, 1kHz, or 100Hz
Power for Active Antennas: Yes – 12VDC to 24VDC in 2V steps
Digital DVB-T, MPEG2 FTA reciever. (DVB-T/T2, MPEG-4 not decoded)
DVB-T/T2 measurement: Yes, both MPEG2 and MPEG4 showing BER, C/N and MER.
Digital Channel Power Function
Memory for Spectrum storage, Channel storage and Favorite storage

General
Input impedance: 75 Ohm, F Connector
Picture-screen: 5. 16:9 TFT color display.
Menus: On LCD 64x128 next to the monitor.
PC-connection Yes, RS232-output.
Battery: Li-Ion, rechargable 12v, 3.5 amp/hour
Operational: About 1.5 hour on a fully charged battery.
Weight: About 3 kg including battery and carrying-case.
Accessories: Nylon carrying-case.
Power-supply of 220v/13.5v, 1.7amp.
Car-charger.

Glossary

8PSK: (8 Phase Shift Keying). This is the modulation type that is used for DVB-S2 also called HD. In 8PSK, a symbol has 8 states or 3 bits. On the constellation diagram, an 8PSK signal either be “Normal”, with the eight points around a circle centred on the origins or “Rotated” 22.5 degrees.

Attenuator: The attenuator inserts an active resistance into the RF path and reduces the signal level about 3 dB.

BER: (Bit Error Ratio) This is the ratio of BitsError/ BitsReceived This is a small number and is usually expressed in scientific notation as BER = 2 X 10-8. Typically, BER should be smaller than 1 X 10-6 for good reception. For DVB-S2, the BER count is not available and the BER shown is an estimate formed from the Total Block Count, Correctable Block Count and Bad Block Count. Use MER for DVB-S2.

dB: (decibel) The decibel is a logarithmic ratio of voltage (or power) to a standard or reference voltage (or power).

$$dB = 20\log\left(\frac{V}{V_0}\right) \quad \text{or} \quad dB = 10\log\left(\frac{P}{P_0}\right)$$

DiSEqC: see Appendix D

DVB-S or DVB-S2: see Appendix C

FEC: (Forward Error Correction) This is the error control used in DVB and other systems to correct errors in transmission. To do this, the data is sent with additional error correcting bits. On reception, the error bits are identified and (usually) corrected.

HD: (high definition) This refers to any resolution above the DVB standard resolution. The DVB standard resolutions for the luminance signal are (H X V):
720 X 576, 544 X 576, 480 X 576, 352 X 576, 352 X 288
The DVB-S2 High definition resolutions are (H X V) 1920 X 1080 or 1280 X 720. They can either be interlaced or progressive. Interlaced means the picture is built from two “fields” with each field being alternating half the scan lines. Progressive means the entire picture is repeated each time. Progressive pictures require a higher data rate.

IF: (intermediate frequency) This refers to the frequency after down conversion at the LNB to the range 950 MHz to 2150 MHz.

I

Q decision points: During demodulation of a QPSK or 8PSK signal, the two phases of the are converted to digital data and this data is sampled at the Symbol Rate. These samples are called IQ decision points (as seen on the constellation diagram) and are then form the digital input symbols.

LNB: (Low Noise Block) The general name for the amplifier and downconverter at the dish.

MaxHold: In the Analog Mode, this can be used to “remember” the highest peak of the RF signal.

MER: (Modulation Error ratio) This is usually expressed in dB. It is calculated from the constellation pattern and represents how close the I and Q decision points are to the ideal position. A typical MER value is 16 dB.

NIT: (Network Information Table) One of the System Information (SI) tables in DVB containing the current satellite name, position, and other data.

P-insert: (Power Insert) This function is used for powering external, active accessories (such as antenna amplifiers) which require a power-source in order to operate. The output voltage may be adjusted between 12 - 24 volt DC and is connected via the BNC-connector. The selected output voltage is always visible in upper-left-hand of the LCD-display (next to the battery-symbol). The default setting of “P – insert” is “Off” (0 volt).
Warning ! Misuse of this function may cause irreparable damage to all connected equipment not intended to accept or receive voltage !

QPSK: (Quadrature Phase Shift Keying) This is a digital modulation used for all DVB-S transmissions. The data is transmitted depending on the phase of the signal with 90 degrees the shift, so four states (one symbol) are encoded at each Symbol Frequency.

QPSK HD: DVB-S2 transmissions can be broadcast in either 8PSK modulation or QPSK modulation, When the demodulator receives a DVB-S2 transmission in QPSK, then QPSK HD” is displayed.

Res BW: (Resolution Bandwidth) The resolution bandwidth shows the incoming signal before the measuring chip-set in the instrument. Choose between the narrow 300 kHz or the wider 1 MHz resolution. The instrument is normally working in the ”auto” mode and the bandwidth chosen is shown on the spectrum display.

SNR: (Signal to Noise Ratio) The SNR of a Signal is a measure of the quality of the signal in dB and higher SNR is better. Typical SNR readings for a clean signal will be greater than 10.0 dB. This is a measurement from the demodulator and is only valid when the received signal is locked.

VID BW: (VIDEO BANDWIDTH FILTER) THE VIDEO FILTER IS PLACED AFTER THE MEASURING CHIP-SET IN THE INSTRUMENT, AND IS USED IN CONJUNCTION WITH VARIOUS RESOLUTIONS WITHIN A SPECIFIED BANDWIDTH. THE RESOLUTION OF DETAILS ON A SIGNAL-CARRIER IS PROGRESSIVELY REFINED IN RELATION TO THE NARROWING OF A FILTER (SWEEP-TIME IS INCREASED). THE DIFFERENT VIDEO FILTERS ARE: AUTO-MODE (DEFAULT), 100 KHZ, 10 KHZ, 1 KHZ OR 100 HZ. THE BANDWIDTH IN USE IS SHOWN ON THE SPECTRUM DISPLAY. INDEX